Value of energy communities in European target countries

PVP 4Grid | TU WIEN TECHNISCHE UNIVERSITÄT WIEN | Energy Economics Group

Overview

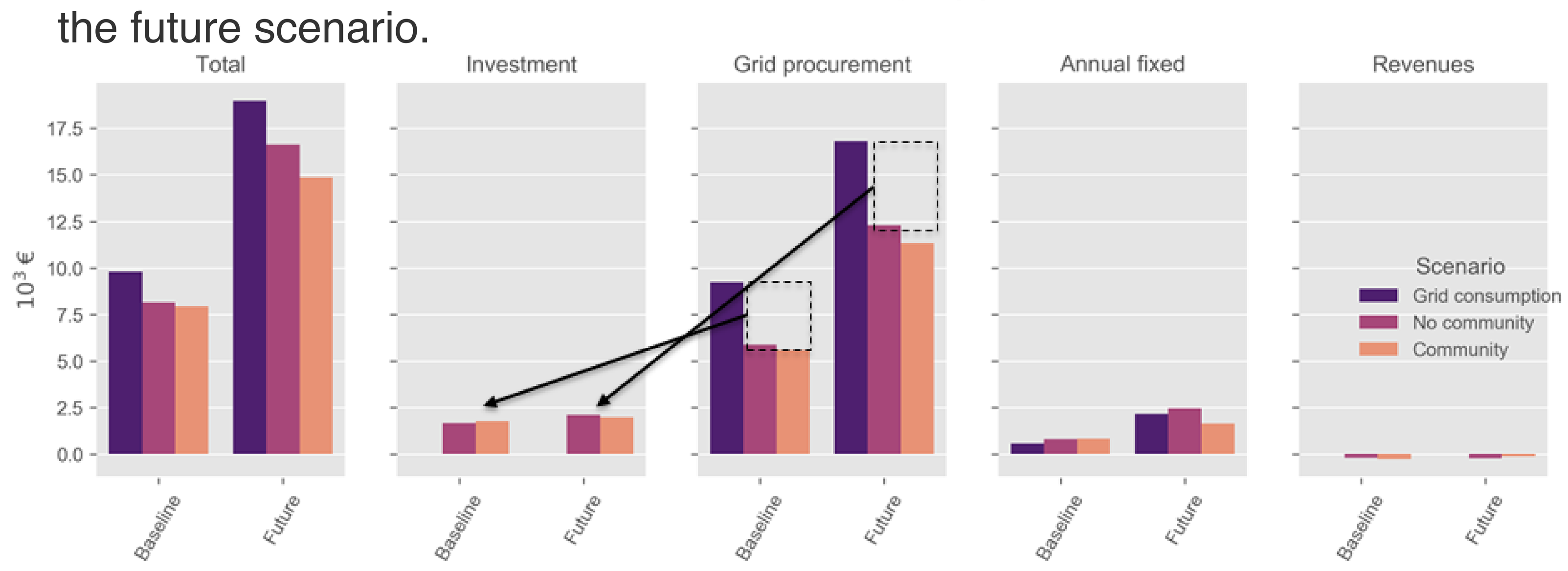
Local energy communities (LECs) enable the collective use (-and investment) of solar energy within a building or a region. Within the project PV-Prosumers4Grid,we identify the value of LECs for selected European targetcountries. The countries differentiate in terms of electricity tariff designs, load characteristics and solar irradiance. The objective of LECs is to minimize costs for energy procurement, by the option of investing into solar photovoltaic (PV) or flexibility systems like energy storages. Nevertheless, the value of LECs can be measured by three key-performance indicators (KPIs):

- Savings for the consumers
- Installed capacities of renewables
- Reduction of peak load and peak feed-in

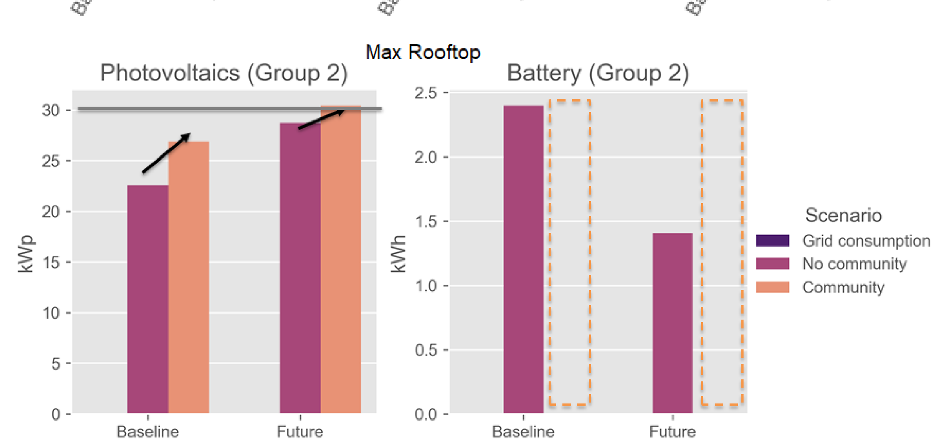
Depending on the individual characteristics of the target-countries, we evaluate for each country the benefit of LECs

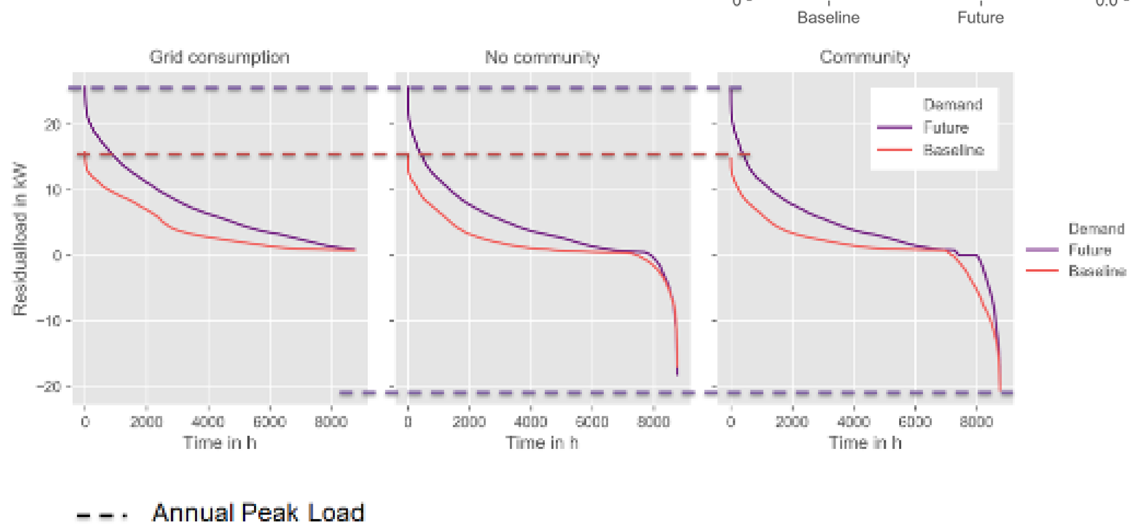
Exchange within an apartment building (Gr. 2)

The total costs decrease with the community approach in the baseline and the future scenario.



The community approach leads to maximum PV penetration and makes batterys redundant. The limitting factor for PV is the roof size.

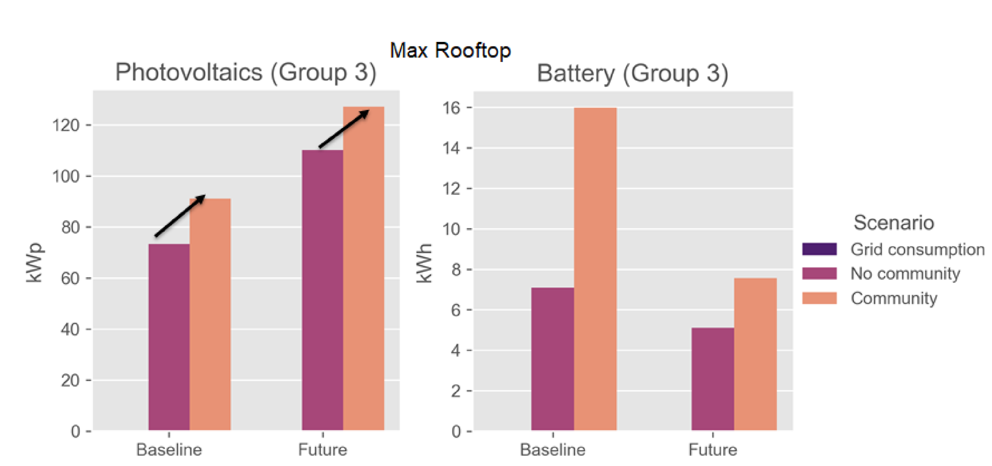




The higher share of PV leads to a higher annualfeed-in peak. The higher demand in the future scenario leads to higherload-peaks.

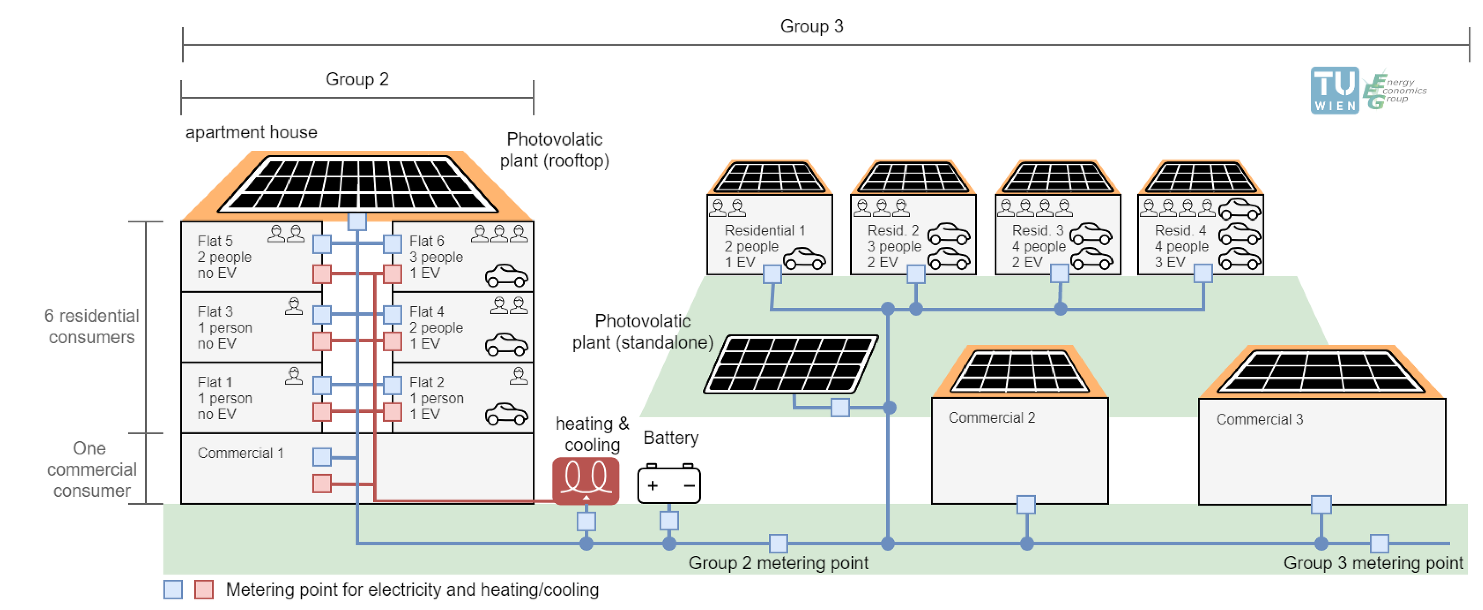
Exchange within a village (Group 3)

The results of exchanging energy within a village are similar to Group 2. A significant difference is, that we don't limit the PV size to the rooftop which leads to higher PV investments. With the increasing excess PV energy it becomes profitable to invest into battery storages.



Methods

The selection of consumers considered in this work represents the average housing situation of Europeans in terms of people per household. Each consumer has an individual load "behavior". For every country we consider a country-specific car usage, as well as heating, hot-water and cooling demand. We differ between community-sizes: Group 1 is each consumer on its own; Group 2 allows energy sharing across an apartment building; Group 3 allows energy sharing across different buildings.

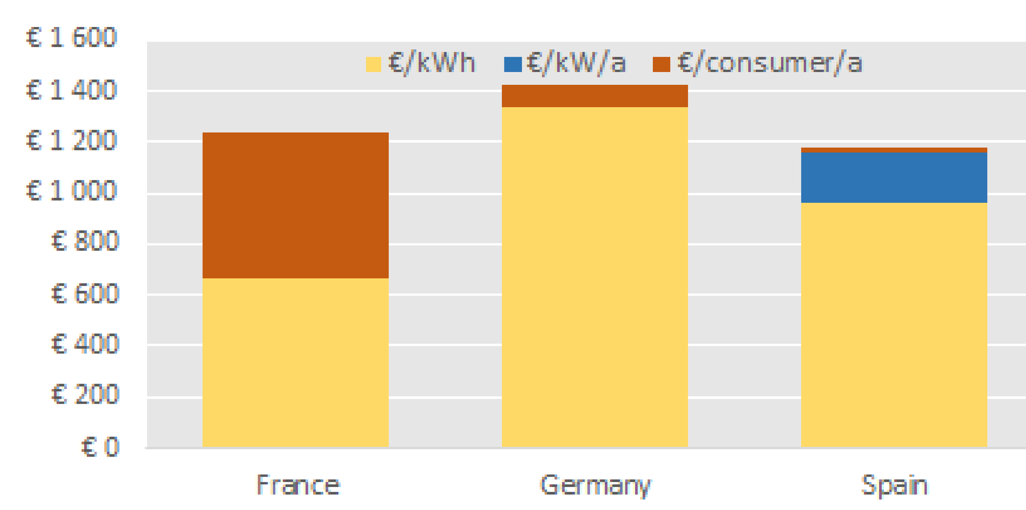


Further, an optimization model evaluates the optimal investments for each consumer to minimize each costs. In the baseline scenario all vehicles and heat are based on fossil fuels, where in the future scenario we have a full switch to electric vehicles and heat-pumps.

Deviation between countries

The investigated countries differ in tariff design, electricity load and PV-production. Tariffs including powerpricing (EUR / kW) benefit the investment in storage technologies, while energypricing (EUR / kWh) has a positive effect on PV investments.

Each country has different electricity costs. A snapshot of electricity bills for consuming 5000 kWh with a peak-load of 4 kW within one year. Some countries apply power-prizing.



Conclusions

- The value of aggregation allows to decrease the costs per consumer, the larger the community becomes.
- The community approach increases penetration and profitability of solar PV and decreases dependence on subsidies.
- In some countries, the grid between tenants in buildings is property of the building owners, wherefore they should not becharged for using their own grid for sharing or exchanging energy betweenthemselves.
- The benefit of optimizing a whole village's energy consumption is the increased share of locally consumed PV energy.

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